Water, Water, Everywhere ...?

Protecting the Municipal Water Supply in Nova Scotia

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This booklet has been prepared by the Water Resources Issue Group of the Nova Scotia Land Use Policy Committee. Its purpose is to explain why planning and protection are needed in water supply areas, and what tools can be used by municipalities in the task of protecting their own drinking water quality. The booklet is intended for municipal councillors, staff and interested local residents—in other words, those who have both the immediate responsibility and the greatest incentive to ensure that our drinking water supply is safe and reliable.

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Introduction

In Nova Scotia, 60 percent of the population depends on municipal water systems for drinking water. Most people assume that the water will be clean and safe, and give little thought to where it comes from or what happens to it before it gets to the tap. Rural residents who rely on their own wells for water are more aware of how the quantity and quality of water can change. But for the rest of us, good water is usually taken for granted—until something goes wrong.

What can go wrong? The problem could be minor, perhaps a temporary change in the colour, taste or clarity of the water; or it could be considerably more serious—for instance, bacterial or chemical contamination involving a serious risk to health. When contaminants get into a municipal water system they can cause disruption in the supply, health problems, lost economic opportunities, and increased water bills.

At first sight, it may seem that the most obvious way to make sure that good quality water is available to the municipality is to install a more sophisticated treatment process. However, this is very expensive and is not necessarily reliable or completely effective. A better way is to anticipate how problems might arise and take steps to prevent them from happening. This means we must protect the source of our water supply, whether it is groundwater, a lake or a river.

Out of a total of 71 municipal water systems in Nova Scotia, 60 are already experiencing significant water quality problems. Some of these problems are caused by the natural characteristics of the water supply area, but many others are the result of inappropriate activities on or beneath the land surface.

The next three sections deal with where our water comes from, the water quality problems created by different land uses and activities, and how water supply areas can be managed more effectively.

Could This be Necessary in Your Home?

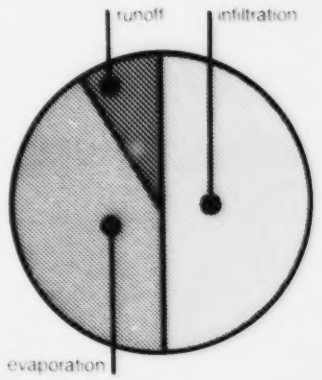
1. Where Our Water Comes From

Water Resources in Nova Scotia

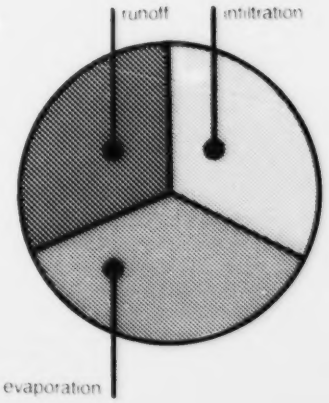
When flying over the province it is hard to believe that water shortage could ever be a serious problem in Nova Scotia. The total annual precipitation is fairly high—approximately 1200-1400 millimetres (50-56 inches), compared to 750-950 millimetres (30-40 inches) in central Ontario or 250-400 millimetres (10-16 inches) in southern Saskatchewan, and there seem to be countless lakes, rivers and streams. The problem is that while there is certainly a lot of water, most of it cannot be used for drinking water supply without extensive treatment.

To look at where our water supply comes from, we have to begin with rain and snow. Some precipitation evaporates from the surface, some soaks into the ground and saturates the soil and rocks below, and some is used by plants. The remaining water runs off the surface, forming a network of streams, rivers and lakes. Whether a particular raindrop becomes surface water or soaks into the ground depends on many factors, including soil type and moisture; the slope of the ground; and the amount of forest cover, cleared land and paved surfaces.

Natural Watershed



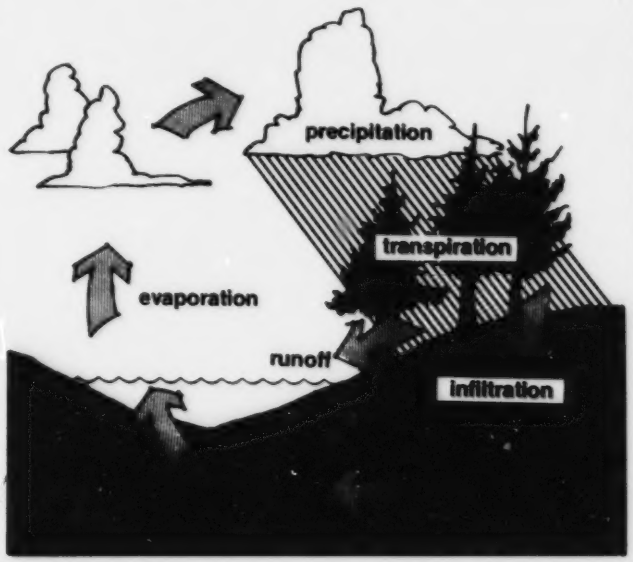
Watershed with 50% Paved Surfaces



Surface Water

When we speak of *surface water*, we mean water which is stored on the ground in lakes and streams. In Nova Scotia we have a lot of it. Large areas of exposed or barely covered rock, and the effects of glaciation, have resulted in the formation of about 6,700 small lakes. They cover about four percent of the land surface.

The Water Cycle



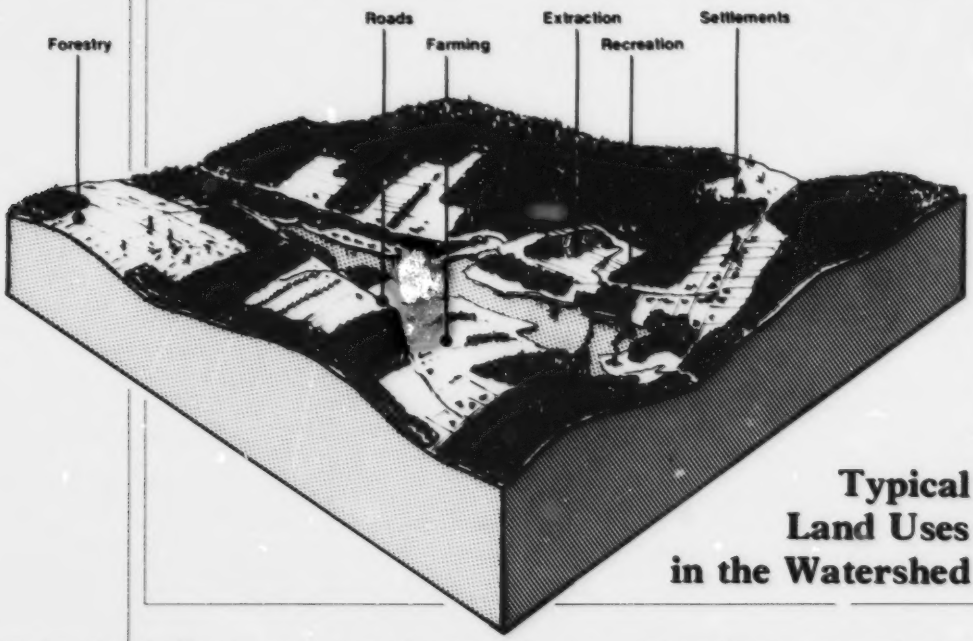
Lakes and marshes are most numerous where water cannot penetrate the bedrock very easily. This happens on rocks such as granite, quartzite or slate. In the southwestern part of the province, for example, lakes cover 11 percent of the land drained by the Tusket River. In areas of sedimentary rock, on the other hand, there is much less surface water. In the River Philip drainage area in Cumberland County, for instance, less than one percent of the surface is covered by lakes and marshes.

The surface of the province can be subdivided into catchment areas or *watersheds*. In each one, the water flowing across the surface ends up in a particular lake or stream. Every river, lake and stream in the province is surrounded by its own watershed. A watershed that is used to supply a water system is called a *water supply watershed*.

Groundwater

Up to 12 percent of the annual precipitation soaks down through the soil and loose rock near the surface to fill the pore spaces, fractures and joints within the rock below. At this point it has become *groundwater*.

Geological formations vary in their capacity to hold water. Gravels and sands, or highly porous sedimentary rock such as sandstone and limestone, can usually hold the most,



Typical Land Uses in the Watershed

but even dense consolidated rock such as granite or quartzite can hold some water in the joints and fractures.

The top of the geological formation in which bedrock is saturated with water is called the *water table*.

If the formation stores and transmits water in sufficient quantities to supply wells, it is called an *aquifer*. There are few really good aquifers in Nova Scotia. The best ones are found in sand and gravel deposits (for example, in the Annapolis, Musquodoboit and Margaree Valleys), and in sandstone areas (Colchester and Cumberland Counties and parts of Cape Breton). Generally, most wells tap groundwater from poor aquifers close to the surface.

The area of land from which water is absorbed into an aquifer is called its *recharge area*. This is equivalent to the watershed of a lake or river.

Although groundwater is held in the pores and fractures in geological formations, it is not static. It moves more slowly than surface water, but it can move great distances over time. In fine sand it might move a few centimetres a day, while in coarse gravel it might move several metres. The speed and direction of movement is determined by a number of factors including the slope of the ground and the structure of the geological formations.

Surface water and groundwater are not separate—they are two parts of a completely interconnected system. Infiltration into the groundwater occurs from surface water, while groundwater seepage contributes to the flow of water to lakes, streams and springs.

Water Supply Problems

There are two main types of water supply problems—those of *quantity* and those of *quality* (or "purity"). This booklet is mainly concerned with quality and how it is affected by activities taking place on the land surface. The particular problems of quantity currently experienced by 15 municipalities around the province are rarely associated with activities in the watershed or recharge area, but have more to do with the size of the watershed, vegetation, the type of soil, and the kind of rocks underlying it.

Types of Water Quality Problems

- bacteria
- pathogenic organisms
- nutrient enrichment
- mineral concentrations
- toxic chemicals
- sediment
- colour
- corrosiveness

Problems Nature Causes

Some water quality problems are also caused by natural characteristics of the watershed or recharge area. "Pure" water is not found in nature because water is an effective solvent and can usually dissolve some part of most materials it encounters.

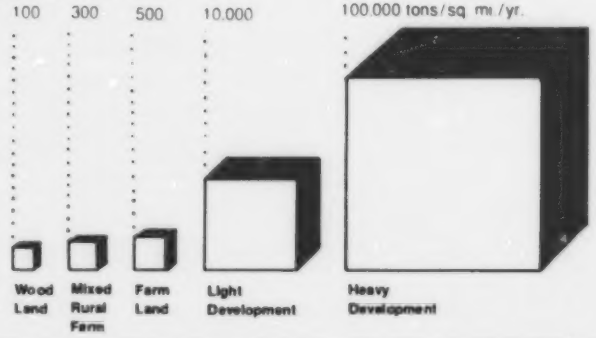
For example, some slates containing sulphide minerals acidify the water and dissolve rocks, adding hazardous metals to the solution; organic matter picked up as water flows through bogs causes colour problems; and diseased plant material can be carried into lakes and streams.

In addition, the scouring action of flowing water can erode exposed soil and carry off large volumes of sediment, particularly during the spring run-off. The heavy sediment load degrades water quality.

It is easy to see that surface water can pick up contaminants as it travels across the surface of the ground, but it is a mistake to think that groundwater is protected because it lies underground within the bedrock. Groundwater is quite easily contaminated, particularly by natural materials, because it remains in contact with soil and bedrock for sufficient time to dissolve soluble minerals.

There are many commonplace contaminants. Iron and manganese, for instance, are readily picked up by groundwater; they can cause taste problems and stain bathroom and kitchen fixtures. Calcium and magnesium dissolved from limestones make the water hard. This can result in difficulty working up a lather from

Volume of Sediment Eroded from Land Under Different Uses



soap and detergent, and in scaly deposits being left on kettles and pots. The sulphate from gypsum can also be a nuisance. In some places, arsenic or uranium are dissolved from the bedrock and give rise to serious health concerns. Near the coast, sea water intrusion can be a problem in some wells.

Contaminants can be found in water even if the land in the watershed or recharge area is undeveloped, but new problems arise when human activities are introduced.

Problems People Cause

Human activity may disturb the natural vegetation, expose or disturb soil, and introduce new contaminants. The quality of the water then not only reflects the natural characteristics of the land, but also the type of activity taking place on it.

Introduced contaminants can include bacteria and viruses, chemicals used to control vegetation and pests, chemicals from accidental spills, oil and gasoline, road salt, and many others. The amount of sediment entering the water may also increase significantly.

Each different type of activity in the watershed or recharge area has a particular sort of impact on water quality. If any activity is carried out with no regard for its effect on surface and groundwater, both can become unusable for human consumption—even after treatment.

2. Land Use Problems

Problems in Water Supply Watersheds

Ideally, watersheds supplying municipal systems should be dedicated solely to the purpose of collecting clean drinking water, but in practice this is rarely the case. Often the watershed is not owned by the municipality and this prevents the restriction of incompatible land uses.

However, while many uncontrolled land use activities are incompatible with providing a good quality water supply, many can be accommodated provided they are managed very carefully. In a multiple use situation, risks must be weighed against benefits.

The Province has produced environmental control guidelines for many activities. These guidelines are not necessarily designed to address the specific problems in any particular water supply area, but offer support when efforts are being made to control the environmental impact of activities that may occur there. Some existing or proposed guidelines are listed under the appropriate sections that follow.

Agriculture

Agriculture is an important land use in some water supply watersheds, and presents a range of problems. Livestock operations can introduce bacterial contamination to the water. Consequently manure piles and grazing should not be permitted near the shoreline of water supply lakes and streams. Certain pesticides and herbicides should not be used at all, while others can be used with specific control measures. Erosion control must be undertaken to limit turbidity problems in streams and rivers caused by sediment-laden runoff from cultivated fields.

Examples of Improper and Proper Culvert Construction

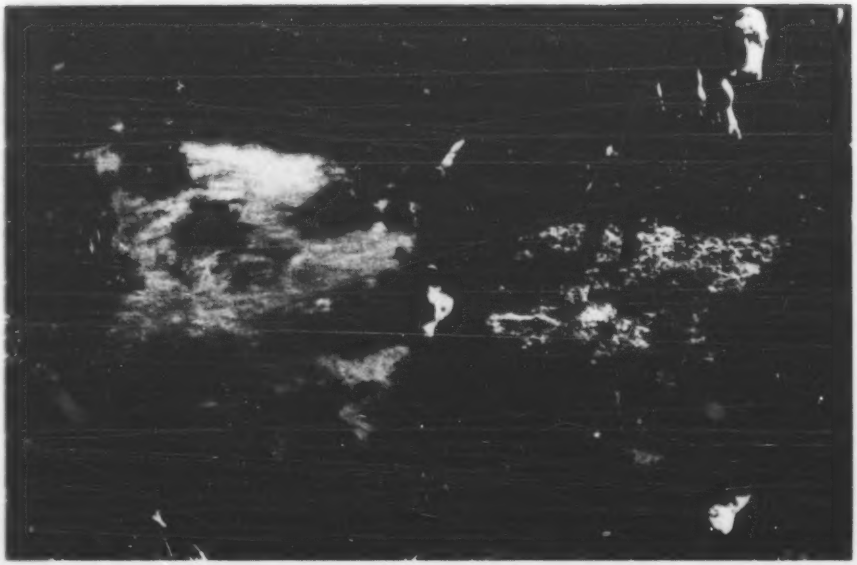
The Nova Scotia Federation of Agriculture has prepared *Guidelines For Farm Waste Management* which focus mainly on livestock manure.

Transportation

The construction of roads and highways in watersheds may cause drastic increases in sedimentation. Some road salt will find its way into the water, but this usually only causes slight increases in salt concentration.

The potential for accidental tanker truck spills of oil, gas, chemicals or hazardous wastes is a major concern in municipal water supply water sheds.

The Department of the Environment closely monitors proposed road and highway construction plans in water supply areas. The Department of Transportation also has environmental guidelines on road construction facilities, stream crossings, borrow pits and the disturbance of mineralized slates. The transportation of hazardous wastes is controlled by the recently proclaimed Dangerous Goods Transportation Act.



Recreation

Water supply watersheds are often attractive for recreational uses. In some cases this is because they have lakes which are accessible by road so that vehicles and boats can be taken in and out, but in others it is because the watersheds are undeveloped and draw people who prefer a wilderness experience.

There are a number of risks associated with recreation. The main one comes from body contact with the water through swimming or boating. These activities may seem harmless enough, but they can lead to contamination of the water with bacteria or other disease-causing organisms. Other incompatible recreational uses include overnight camping and the use of motor boats.

To minimize the risk, the terminal lake or reservoir in a watershed (where the intake pipe is located), and the area of land surrounding it, should not be used for recreation. Controlled day-use activities such as hunting, fishing, hiking and skiing can often be permitted in other areas of the watershed, though.

Urban Development

In Nova Scotia, nearly all water supply watersheds contain some housing—sometimes even complete subdivisions. In these places, the main water quality risks come from the initial construction, faulty sewage disposal systems, solid waste disposal, leaking fuel storage tanks, and storm water run-off.

As a general principle, urban development should be actively discouraged in water supply watersheds. Unfortunately some municipalities have to draw their water from areas in which there are established communities. In these areas, new development must be managed very carefully using good planning, design, and environmentally sound construction practices, to make sure that any existing problems are not compounded by new ones. Also, ongoing problems, such as poorly functioning private or public sewage disposal systems need to be dealt with as matters of the highest priority.

To assist with the management of urban development in water supply areas, the following guides can be used:

- *Erosion and Sediment Control Guidelines for Use on Construction Sites* have been prepared by the Nova Scotia Department of Environment.
- *Regulations Respecting Subdivision of Land to be Serviced by On-site Sewage Disposal Systems*, and *Regulations respecting On-site Sewage Disposal Systems* have been prepared by the Nova Scotia Department of Health and Fitness.

Extractive Industries

Mining and quarrying involves three types of activities: exploration, extraction, and processing.

Exploration

Some aspects of exploration involve activities such as airborne surveys, prospecting, geological mapping, geochemical and geophysical surveys. These usually cause no significant surface disturbance and do not affect water quality. Other exploration activities such as drilling, blasting, trenching or water course alteration can pose some risk to water quality if they are conducted without regard for their environmental impact.

Extraction

The extraction of rock and minerals obviously does create a significant amount of surface disturbance and can lead to an increase in the amount of sediment reaching lakes and streams. In addition, mining and quarrying can cause the water table to be lowered, and surface water

may be contaminated by spills of petroleum and oil from machinery. In certain areas the exposure of slates rich in sulphide minerals can produce enough acidic and metal-rich runoff to make water undrinkable.

Processing

Mineral processing may necessitate the use of hazardous chemicals, which can impose risks in terms of transportation, storage and disposal. Also, when rock is crushed to make aggregate, a significant amount of dust may be produced which can be carried from the site in runoff.

With these potential problems in mind, exploration and extraction should always be subject to stringent controls in water supply watersheds, and processing which involves the use of hazardous chemicals should not be permitted at all.

The following guidelines are available from the Nova Scotia Department of the Environment to provide direction for extraction activities.

- *Environmental Guidelines for Surface Mining Operations*
- *Proposed Pit and Quarry Regulations*
- *Draft Guidelines for Development on Slates in Nova Scotia*

Forestry

Forest land must be managed if it is to be productive and if pests and fire are to be controlled. At the same time, poor harvesting practices can cause erosion; accidental fires; chemical contamination from fertilizers, pesticides or herbicides; and fuel spills. Also the 900 kilometres (540 miles) of forest roads which are built every year in Nova Scotia can make a significant contribution to the sediment load in streams and rivers unless they are constructed using environmentally sound construction practices.

Well planned and responsible forest harvesting is compatible with high water quality standards, and should be carried out in the water supply watershed to ensure that the forest is healthy.

The following guidelines and standards can be used as part of a forest management framework for water supply watersheds:

- The Pest Control Products Act has been proclaimed in Nova Scotia and regulations have been developed to govern the use of chemical control agents.
- *Environmental Standards for the Construction of Forest Roads and Fire Ponds* have been developed for the forestry industry.
- *Forest Wildlife and Environmental Guidelines and Standards* have been developed and put in place by the Nova Scotia Department of Lands and Forests.

Problems in Groundwater Recharge Areas

Any liquid which comes into contact with the ground may eventually seep downwards and pollute the groundwater. Once the contamination has occurred, it moves through the rock as a plume which is not easily seen or controlled and consequently is very difficult to clean up. It has been estimated that even after extensive cleanup work, at least 50 percent of leaked substances remain in the ground. For these reasons, special attention has to be paid to avoiding contamination in the unseen water supply.

Groundwater pollution problems can start at any one of several levels: on the surface of the land, in the ground but above the water table, and below the water table.

Groundwater Problems at the Surface of the Land

Many groundwater pollution problems are caused by the dumping, spreading or storage of soluble substances on the ground surface. From there they are carried down to the water table where they disperse in the groundwater.

In many ways, the sources of contamination are the same as those for surface watersheds. They can be summarized as follows:

Urban Development—leakage or malfunction of sewage disposal systems, garbage dumps, runoff from streets and gardens;

Above the Water Table	Below the Water Table
• storage tanks and pipelines • septic tanks, cesspools and privies • holding ponds and lagoons • waste disposal in excavations • garbage dumps • dry wells used for waste • graveyards	• extractive industries • dumping in quarries and pits • drainage channels in fields • dumping in abandoned wells • underground storage

Agriculture and Forestry—fertilizers and pesticides, manure used as fertilizer or stored improperly;

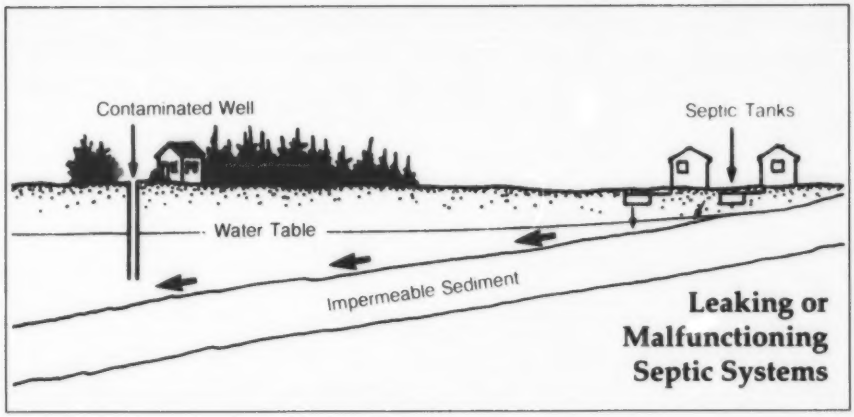
Roads and Railways—spills of chemicals, salt;

Underground Petroleum Storage—leaking tanks;

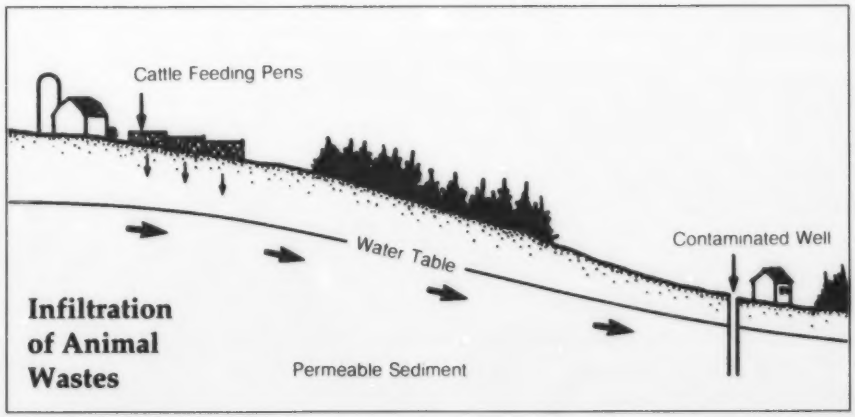
Waste Disposal—dumping or spreading of garbage, manure, sludge or industrial waste.

Groundwater Problems Below the Surface of the Land

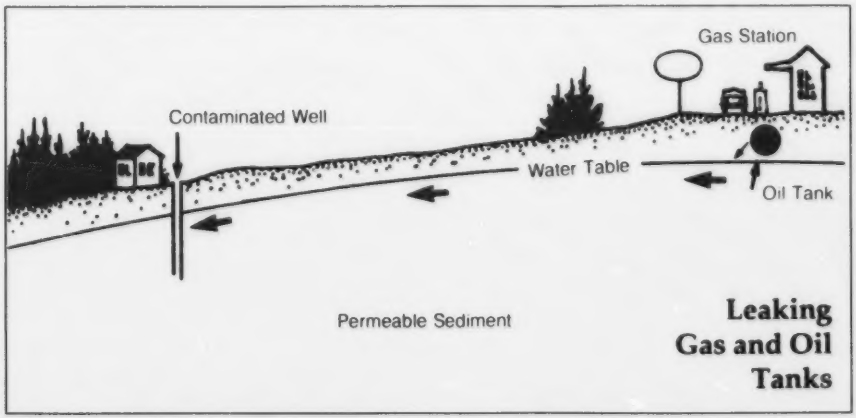
It can be very tempting to ignore the risk of leakage when potentially polluting substances are being used or stored below the surface. Problems may develop from the uses listed in the table on the previous page.



Leaking or Malfunctioning Septic Systems



Infiltration of Animal Wastes



Leaking Gas and Oil Tanks

Municipal Water Systems in Nova Scotia

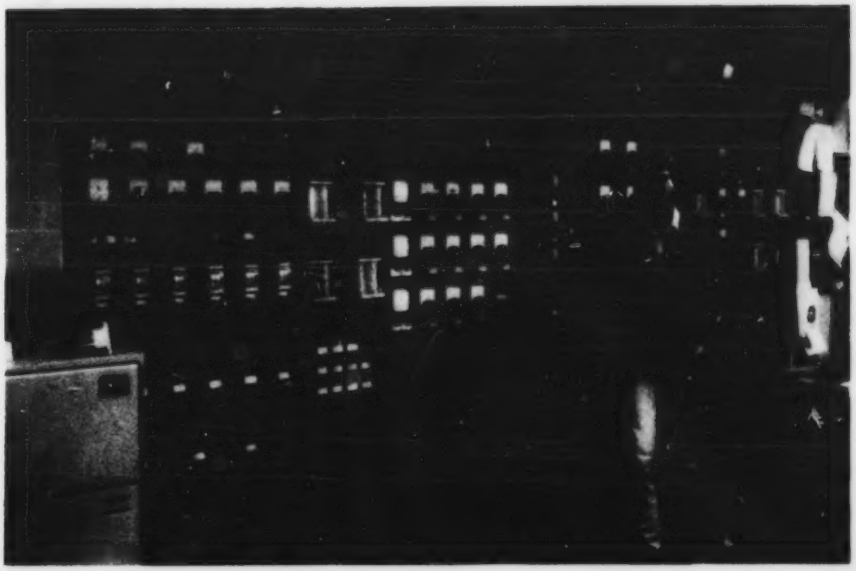
Current Situation

Out of 56 surface watersheds used to supply potable water in Nova Scotia, 48 have significant water quality problems, many of which stem from inappropriate activities or land uses in the watershed. In addition, 19 of the 25 groundwater supplies also have problems.

The water in every municipal water supply system must be treated before it can be considered safe for human consumption. The type of water treatment required depends partly on the natural water quality, and partly on the types of land use in the watershed or recharge area.

If the water supply area is used primarily to collect water for the municipal system, and the water utility is able to ensure that only compatible land uses and activities take place, the minimum level of treatment (pH adjustment, filtration and disinfection) may be adequate to prevent bacterial contamination. However, as the number of uses permitted in the water supply area increases, quality decreases and more sophisticated—and expensive—treatment processes have to be used.

Unfortunately, treatment cannot be considered to be the only answer because water treatment facilities may break down, or be unable to deal with drastic changes in raw water quality such as can be caused by a chemical spill or a sudden increase in the sediment load of the



raw water. These changes in water quality may then require that additional or different treatment processes be installed—usually at considerable expense.

In addition, there are many chemicals which either cannot be removed by normal treatment processes, or are so hazardous to human health that even very small quantities can provide reasons to shut down the water supply system.

To maintain high standards of water quality, it is necessary to use a "multiple barrier" approach—and treatment is just one of these barriers.

In order to reduce both costs and risks, another "barrier" is needed—the protection of the raw water quality by minimizing contamination from the land uses in the water supply area.

The introduction of mechanisms to control land uses is complicated by the fact that most of the land in water supply watersheds is not owned by the Crown or the water utility. In fact, in only about a quarter of cases is a substantial portion of the watershed or recharge area (75 percent or more) publicly owned. Furthermore, in about half the cases, the municipality operating the water system does not have any jurisdiction over the water supply area because it is located in another municipality.

3. Managing the Water Supply Area

Who is Responsible?

Clearly, municipal governments are on the front line, because they have the responsibility for providing the water supply, and also for planning and land use control. But the job cannot be done by the municipalities alone. Several important pieces of legislation plus regulations and guidelines are administered by the Province, and others come under federal authority. Consequently, the successful management of a water supply watershed or recharge area requires the co-operation of all three levels of government, and also the active involvement of the general public.

Since 1919, all water courses in Nova Scotia have belonged to the Province, and water resources management is now part of the mandate of the Nova Scotia Department of the Environment. Water use is managed through the issuing of licenses, and municipal use is considered to have the highest priority. In addition, the Department has put in place several pieces of legislation and regulations which are designed to help the municipalities in their job of protecting a good quality water supply.

Overall, four provincial departments administer legislation to assist the water utility operators; they are the Departments of the Environment, Health and Fitness, Lands and Forests, and Municipal Affairs.

The main legislative responsibilities are held as follows:

Water Utility / Operator
- Public Utilities Act

Local Municipality
- Municipal Act
- Towns Act
- Village Services Act

Dept. of Health and Fitness
- Health Act

Dept. of the Environment
- Water Act
- Environmental Protection Act
- Environmental Assessment Act
- Dangerous Goods and Hazardous Wastes Management Act
- Pest Control Products Act
- Well Drilling Act

Dept. of Municipal Affairs
- Planning Act

Dept. of Lands and Forests
- Forest Enhancement Act

The Government of Canada is primarily involved through the application of the Canadian Water Quality Guidelines, the enforcement of sections 31 and 33 of the Fisheries Act, and through the Canada-Nova Scotia Flood Damage Reduction Agreements.

Management Tools

A municipality or water utility has a number of options to draw on in order to protect water quality.

Ownership

The most reliable way to control exactly what happens within the boundaries of the water supply watershed is for the municipality to own all the land. Unfortunately, this is not always the most practical option because the land may not be available or may be too expensive. In these circumstances, another option is to purchase buffer strips of land around lakes or streams.

Designations and Regulations

The Water Act, as amended in 1968, allows the Minister of Environment to designate Protected Water Areas in which the Minister may

....prohibit or regulate the doing of any act or acts in an area so designated that may impair the quality of the water in the source of water supply.

Twenty one Protected Water Areas have been designated. In most cases regulations are attached which focus on both land-based activities, like clear-cutting or garbage dumping, and water-based activities such as swimming and boating.

In 1988, more amendments were made to the Water Act including an increase in the severity of penalties for violation of the Act. Penalties for the first offences now include a maximum fine of $50,000 and, in the case of default, a one year prison sentence. For a second offence, the penalty increases to $75,000 and, in the case of default, a two year prison sentence.

In the past, designation has often encountered opposition from local landowners and users who worry about being unduly restricted in their accustomed activities. In many cases it has been possible to deal with these concerns by doing three things. First, make sure that the public understands why it is necessary to protect the water supply area; then develop regulations which are acceptable to both the utility and the public; and finally, establish a monitoring program to make sure that unexpected problems are identified early.

Land Use Planning

Land use planning offers an opportunity to avoid many water quality problems by ensuring they have no chance to occur. Since 1983, water supply watersheds and recharge areas have been included in the Planning Act as matters which can be addressed by both provincial land

use policies and municipal planning strategies.

While a planning strategy can deal with many aspects of development such as permissible uses, setbacks and lot sizes, and can establish policies for water supply watershed management, it cannot control the activities that take place on the land—such as the exposure of mineralized slate or spraying of pest control chemicals. This has to be done through a variety of other means using a combination of existing legislation and regulations, and occasionally new legislation.

Many municipalities have included water supply protection policies in their planning strategies, they include Dartmouth, East Hants and Cape Breton County.

If the water supply area lies within the jurisdiction of a neighbouring municipality and no co-operative mechanism can be found for protecting the watershed, annexation may have to be considered under the Municipal Boundaries Act. The Town of Truro has recently used this option.

Forest Management

A forest management plan can be developed which has protection of water quality as its first priority, and fiber production as its second priority. This ensures that water quality is not adversely affected by the side effects of infestation, fire and decay which characterize an over-mature and unmanaged forest.

Treatment

Some form of treatment is required for all water supplies—at a minimum, pH adjustment, filtration and disinfection for surface water; and disinfection for groundwater. Further treatment may also be needed to correct natural problems—for example high levels of iron or some other mineral in the water. When the range of contaminants can be kept reliably within a narrow band, the treatment process can be maintained at minimum cost and can provide maximum health protection.

Public Involvement

To maintain high water quality standards, it is essential to have the involvement and co-operation of everyone living in or using the water supply area. Even the most comprehensive legislation and regulations cannot protect the water supply if

people do not know about them or if they are ignored. This means that the public must become involved in water resource management. It has been shown in a number of areas that local residents have a considerable interest in protecting their surrounding environment.

The Dartmouth Lakes Advisory Board, which formed in 1971, has served as a role model for citizens' involvement in watershed management right across Canada. Seven similar advisory groups have now been formed in Nova Scotia. Two of these, the Petite Riviere Watershed Advisory Group and the Shubenacadie/Grand Lake Watershed Advisory Board, have as their main focus the protection of their municipal water supply areas.

Guidelines and Regulations

Once people start to make the connection between what happens on the land and the quality of the water supply, the next question is usually "So what should I do about it?". If there are going to be multiple uses in a water supply area, people will need advice on how to go about them in a conservation-minded manner.

A number of agencies have drawn up technical guidelines and regulations that can be used to help protect water quality. Several have been mentioned before. They cover the following areas:

Agriculture
- livestock, manure and farm waste management

Construction
- forest roads and fire ponds
- forest management
- buffer strips for fish and wildlife

Mining
- surface mining
- pits and quarries
- development on slates

Pesticides
- use, handling and disposal of products
- pesticide safety

Petroleum products
- storage and handling

Roads
- construction practice specifications

Sewage disposal
- subdivision servicing
- on-site sewage disposal

Solid wastes
- selection criteria for municipal dump sites
- selection criteria for sanitary landfills
- standards for fish waste disposal

Water quality

Hazardous wastes

Putting It All Together:

Comprehensive Water Supply Area Management Plans

It is unlikely that any one of the management tools for water supply protection will be sufficient, especially if the watershed or recharge area is large and has multiple uses. A comprehensive water supply area management plan is a new approach to water quality protection, which may involve a combination of methods.

In ideal circumstances, the conceptual course of action for developing water supply area management plans can be visualized in the following steps:

- **Statement of Ultimate Goal and Objective**

All interested parties including municipal governments, water works owners/operators, experts and the general public must come to a concensus on what the ultimate objective is in designing a comprehensive water supply area management plan. Only after defining clear objectives and goals can meaningful options be identified and evaluated.

- **Identification and Evaluation of Options**

Although the identification and evaluation of options requires the input of expert opinion and may involve highly technical reports and analyses, the general public must also be involved in assessing the tradeoffs between short term costs and long term benefits as they differ from one option to another.

- **Selection of Preferred Option**

On the basis of careful analysis of various options and the integration of both expert and public opinion, a preferred option is identified and selected for implementation.

- **Implementation and Monitoring**

The planning process has as its ultimate objective the adoption and implementation of a preferred option. In practice, however, the process is generally dynamic and the inclusion of a monitoring phase implies that the process is in fact iterative. Monitoring may result in a change to the plan objective or in the determination that modifications to the plan are required due to changing circumstances. The course of action described in the preceding steps may be cyclical in some respects.

Information collection, management and analysis forms a significant part of the planning process. It also follows clearly defined steps.

First the water supply area must be analyzed, by examining:

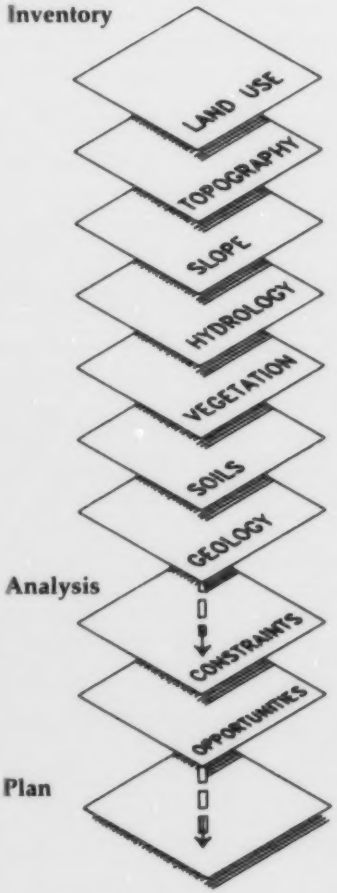
- the natural features
- the existing resource use and physical development
- possible future changes in land use
- present contaminants and possible new contaminants

A water supply management plan is then prepared. A combination of methods may be used. For example:

- designation of the water supply area under the Water Act
- land use controls under the Planning Act
- selective land purchases
- the development of specific regulations
- monitoring of water quality
- improved water treatment

It is very important to ensure that all those affected by the management plan are involved in preparing it. Recent events in three watersheds (Lake Major, Minamkeak and Lepper Brook) have shown that the involvement of residents is essential, and if they are left out of the decision making process, the result may be strong protest and protracted negotiations. With this in mind, the planning process needs to involve:

Physical Planning Process



- landowners and resource users in the water supply area;
- the municipal governments which represent both the landowners and the water supply users;
- the water utility;
- the Province.

Each watershed is different, and consequently each management plan should be individually designed. An additional benefit of the comprehensive planning approach is that it provides a chance to carry out a long-term evaluation of the drinking water resource, and to identify where municipal money is best spent.

To illustrate how these municipal watershed management plans can be put together, two very different examples can be examined: Bridgewater (Minamkeak Lake), and Truro (Lepper Brook).

Bridgewater (Minamkeak Lake)

In 1975, Minamkeak Lake was designated a Protected Water Area by the Minister of the Environment at the request of the Bridgewater Public Service Commission. At the same time, fairly stringent regulations were also enacted to protect the water supply. However, local

residents were not included in the planning process and the regulations were opposed by many property owners. As a result, in 1976, the Nova Scotia Department of the Environment agreed to review the designation.

The review took place in several parts, as follows:

- the original watershed boundary was interpreted from aerial photographs and subsequently surveyed on the ground to follow the topography more accurately; this change resulted in the withdrawal from the Protected Water Area of many acres of land in the most heavily populated part of the area;
- a consultative committee called the Petite Riviere Watershed Advisory Group was formed;
- the Advisory Group developed a new approach to protecting the water supply which involved a water monitoring program and a completely revised set of regulations;
- in 1981, the designation was reviewed again, and a new comprehensive set of regulations was introduced; also a guidebook was prepared to provide the public with information on how to use the watershed.

Truro (Lepper Brook)

The management plan for the Lepper Brook watershed (1988) draws together a number of management mechanisms which provide an effective, enforceable control package. Basically, the main elements are:

- the establishment of an Advisory Committee involving the Town, Water Utility, landowners, and representatives of the provincial Departments of Health and Fitness, Environment, and Lands and Forests;
- the development of a public information program, with the help of the Committee, to alert the general public to the importance of protecting the quality of drinking water at the watershed level;
- proposed designation of the watershed under the Water Act—without attaching regulations, to begin with. This is to allow time for people to become familiar with the special status of the watershed and give them an opportunity to become involved in the process of developing regulations;
- development of regulations with the help of the Committee;
- preparation and implementation of a Forestry Management Plan;
- acquisition of sensitive land by the Town, as it becomes available;
- introduction of land use controls;
- designation of a Wastewater Management District to maintain and operate on-site waste disposal systems; and
- monitoring of water quality in the streams and the reservoir.

The preferred method of proceeding is in a consultative manner in which all interests are represented, the problems of water supply management can be explained to a wide number of people, and local concerns can be addressed as fully as possible within the context of good water quality management.

Last Word

By undertaking a watershed management plan, each municipality can take charge of the security of its own water supply for both quality and quantity. The plan can be designed from the ground up, taking into consideration the unique combination of opportunities and constraints in each case. In addition, the process of developing the plan can be used as a vehicle for raising public awareness of the need for:

1. Safeguarding public health
2. Securing long-term municipal investment; and
3. Protecting a fragile environment.

For More Information

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